

# A Student-Centric Approach to Large Introductory IS Survey Courses

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## ABSTRACT

Both instructors and students dread large introductory courses. IS introductory courses are no exception as they are often too large, the material too dry and the atmosphere too impersonal. This paper describes a unique student-centric curriculum for delivering introductory IS survey courses that keep students interested and engaged while producing high-quality learning outcomes. In the classroom, students experience a relaxed atmosphere created by dimming the lights, playing topical music, and joining in friendly banter with the professor. At random times game shows are initiated; the winning contestants are rewarded with tokens that can be redeemed in an online-gift catalogue. Outside of class students complete prerequisite exercises at their own pace, submit homework assignments up to three times and take the quizzes according to their own schedule. In designing this curriculum three objectives are met: 1) students enjoy the classroom experience; 2) students have greater control over the learning process, and 3) students master more difficult material. All this is accomplished using a proprietary online classroom management application called Orion. We believe that prerequisite exercises are likely to have a positive impact on student's test scores.

**Keywords:** Large Introductory Classes, Pedagogical Issues, Curriculum Design, Active Learning, Learning Environment

## 1. INTRODUCTION

Organizations have readily used information systems to improve the efficiency and effectiveness of their business processes, provide information for more effective decision-making, and enable workgroup collaboration among employees and partners throughout the world (O'Brien and Marakas, 2006). Because they play a meaningful role in improving organizational productivity and profitability, the study of information systems has become an essential discipline in undergraduate and graduate business programs.

In most undergraduate business programs students are first exposed to information systems (IS) using an introductory survey course. The typical curriculum covers a vast array of subjects including data and information characteristics, operating systems, information system development, database theory and design, hardware and software concepts, the use of information systems in

decision-making and information systems in e-commerce and Internet security. While the objectives of this approach are laudable, they are often not realized: introductory classes are usually too large, focus too broadly on most topics, are populated with students with a variety of backgrounds and interests, and are often perceived as impersonal. Students often enroll in these courses primarily to satisfy graduation requirements rather than to satisfy an inherent interest in the subject matter. Hence, neither students nor professors are satisfied with the learning experience and, more importantly, graduates from business schools do not master fundamental IS skills before entering the professional world. This is not a desirable situation for students, the institutions granting their diplomas, or their potential employers.

We discuss a unique curriculum for delivering introductory IS survey courses that keep students interested and engaged while producing high-quality learning outcomes. In designing this curriculum three objectives are

met: 1) the classroom experience is enjoyable; 2) the students have greater control over the learning process; and 3) the students are exposed to (and master) more difficult material such as creating SQL statements. This is all accomplished using proprietary application software (called Orion) developed by the professor to specifically manage all aspects of the student learning process online.

The remainder of this article is organized as follows. First, the state of the art of the current pedagogical literature on curriculum design is examined. Next, how these design considerations were met by the IS curriculum described above is discussed. Finally, insights gained from development of this curriculum are provided.

## **2. PEDAGOGICAL CURRICULUM DESIGN CONSIDERATIONS**

Factors to consider when designing a curriculum include creating a positive learning environment, incorporating active-learning techniques, allowing students to control their learning process, providing practice opportunities and administering formative assessments.

### **2.1 Positive Learning Environment**

According to Dewey (1916/1966) "we never educate directly, but indirectly by means of the environment" (pp.19). Critical components of the learning environment, including the physical surroundings, psychosocial or emotional conditions and social or cultural influences, have been found to impact student participation and satisfaction (Hiemstra, 1991). Hence, student learning outcomes are directly influenced by the learning environment; a positive learning environment, characterized by openness, a relaxed setting and a non-threatening atmosphere, is conducive to a higher degree of learning (Fulton, 1991). Entwistle (2005) concluded that students' perceptions of the interaction of various types of teaching, e-learning, assessment criteria and procedures, assignments, feedback and workload affect the quality of the learning they achieve. Finally, Zimbardo (2005) concludes that professors can create an optimal learning environment by making the learning process memorable, right, relevant, and better each time.

### **2.2 Active Learning Techniques**

There is consensus among pedagogical researchers that active learning techniques have a positive impact on the quality of students' learning (Astin, 1984; Association of American Colleges, 1986; Miller, 1988; Bonwell and Eison, 1991; House, 2002; Kvam, 2002; McClanahan and McClanahan, 2002; Udovic et al., 2002). Active learning theory suggests that students become an integral part of the learning process by studying ideas, solving problems and applying what they learn.

Researchers have found that active learning is related to higher levels of confidence in student's discipline-based knowledge (Anderman and Young, 1994; House, 2002); learning involvement and motivation (House, 2002; Udovic et al., 2002); problem solving abilities (Zoller, 1987); developing independent learning skills and the ability to apply knowledge (Sivan et al., 2000); and increasing the

retention for students whose performance is average or below average (Kvam, 2002).

Educational games have been identified as an especially effective active learning technique. They are characterized as being enjoyable (Lawson, 1995), motivating (Watson et al., 1996), help students increase their confidence with class material (Townsend et al., 1998) and improve their higher order thinking and reasoning skills (Hogle, 1996). Games that are considered fun are those that are intrinsically motivating and offer the right amount of challenge (Malone, 1980; Lepper and Malone, 1987; Malone and Lepper, 1987; Malouf, 1988; Allen, 2003).

### **2.3 Student-controlled Learning Process**

Zimbardo (1969) and other researchers (Malone, 1980; Lepper and Malone, 1987; Malone and Lepper, 1987; Liao and Tai, 2006) have shown giving people a choice (or even a perception of choice) can increase their motivation to do a task. People are more motivated to perform specific tasks when they can exercise free will. This applies equally to the learning process. Students are more motivated to complete homework and practice exercises when they are given the opportunity to regulate their learning process (Csikszentmihaly, 2000; Lin and Hsieh, 2001; Zimbardo, 2005).

The notion of learner control has become much more popular with the advent of computer-assisted instructional programs. Students find it intrinsically appealing because it allows them to tailor elements of instruction to their individual needs and preferences. Based on their existing knowledge and learning goals students customize their learning program by choosing the particular exercises they want to complete, the method of instructional delivery and the time and place where they receive the instruction (Lin and Hsieh, 2001).

Students who could choose to select and complete exercises had significantly more positive attitudes toward learning tasks than those who had no choice over the exercises they completed (Schnackenberg and Sullivan, 2000). These more favorable overall attitudes toward learner control are consistent with results obtained from other researchers (Kinzie and Sullivan, 1989; Morrison, Ross and Baldwin, 1992; Hannafin and Sullivan, 1995).

### **2.4 Practice Opportunities**

Lepper and Malone's research (1987) suggests that students spend more time on activities that engage their interest. This leads to better learning of the course material and more sustained interest in future encounters with the subject matter. For example, Trabasso (1987) and Kritch and Bostow (1998) found that computer-based learning was strengthened in those students who practiced by asking frequent questions. These authors highlight the importance of instructional techniques that require learners to repeatedly and overtly practice the desired behavior. Answering more questions increased not only student performance on quizzes but also the extent to which students could subsequently accomplish a relevant applied skill. This supports the notion that increased interactivity produces increased learning (Schaffer and Hannafin, 1986; Fletcher, 1990).

Students' interest tends to be more stimulated when practice evokes misconceptions about newly learned information (Smith and Ragan, 1993). Hence, designers should consider ways in which learners might misunderstand lesson content, then design practice experiences that allow learners to discover their misconceptions and correct them.

### 2.5 Formative Assessment

Formative assessment is used to provide feedback to students rather than to evaluate them for course grades. It provides the means by which students can assess their own progress and understanding of the course material (Brown and Knight, 1994; William and Black, 1996; Seale, Chapman and Davey, 2000) and evaluate their progress against an established norm (Smith and Ragan, 1993; Wiliam, 2006). Having received feedback on their performance, students may then take steps to remedy whatever weaknesses the assessment has exposed. The primary goal of formative assessment is to help learners close the gap between their actual and desired levels of performance (William and Black, 1996). Bransford et al. (2000) note that formative assessment designs should capture student attention as well as motivate them to improve their performance. Formative assessment must be provided at an appropriate point in the learning process and must contain a prescription for action to improve student performance (Brown and Knight, 1994; William and Black, 1996). Students need to develop a plan of action composed of specific steps to address their weaknesses as well as dedicate sufficient time to implement their plan.

Formative assessment administered online takes advantage of the predominant way students currently communicate. Online technology allows students to access course-related material at the times and places of their choosing (Bostow, Kritch and Tomkins, 1995), retake a test as often as needed to master the subject matter and provide individualized feedback in a flexible, non-threatening and cost-effective manner (Zakrzewski and Bull, 1999). Buchanan (2000) has reported that a web-based formative assessment strategy increases student interest in learning and improves student test scores. The more diverse the formative assessment strategies embedded in the online learning environment are, the more students tend to learn (Darling-Hammond, 2000).

## 3. DESIGN CONSIDERATIONS IN THE NEW CURRICULUM

### 3.1 Enjoyable Classroom Experience

This introductory class averages between 400 and 450 students per semester and meets for 1¼ hours twice a week in a large auditorium. The atmosphere in the auditorium is controlled by the professor to create a positive learning experience as defined by Dewey and described by educational researchers such as Zimbardo (2005) and Entwistle (2005).

The lights are dimmed while soft music is played and pictures of various pieces of art are displayed on the main viewing screen. The dimming of the lights and the rate at which the artwork is displayed has an obvious calming effect. The music and artwork is changed periodically to

maintain interest. This mood is maintained until the class begins.

Developing a real rapport with approximately 400 students is a much more difficult feat. Typically open-ended questions are bandied around between the students and the professor before class officially starts. The questions are very topical and often lead to a stimulating dialogue. Anyone can participate as long as their remarks and behavior are not offensive. Topics such as upcoming quizzes, and tests or group performances on previous exercises and exams are discussed. Individual questions are reserved for after class. Consistent with Hiemstra (1991), one of the primary goals of the early interaction between professor and students is to establish a trusting, safe, and supportive environment that facilitates learning.

To enhance learning involve and motivation (House 2002, Udovic et al. 2002) and to install higher levels of confidence in subject material (Anderman & Young 1994, House 2002), the professor makes use of active learning techniques such as guided lectures, discussions and educational games while delivering the course material using PowerPoint slides. These techniques enhance learning involvement and motivation and game show-like activities pop up on the screen at random times accompanied by specific theme music and colorful graphics. Randomly selected "contestants" alone or in teams come to the front of the auditorium where they are asked questions pulled from a test bank containing all the course-related material presented to that date.

The object of participating in the game shows is to acquire tokens (see Figure 1) that can be redeemed to purchase "gifts" from Orion's Online Gift Catalog.

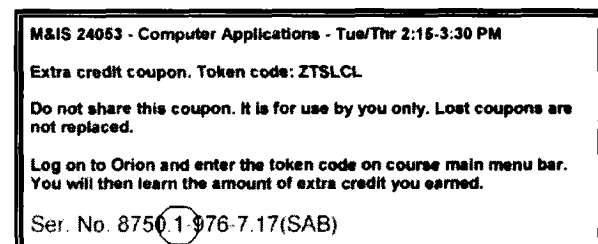


Figure 1: Token distributed in class. The value of the token is circled (.1).

Three types of games are available: Game 1 requires one student to answer one question correctly within ten seconds. The second game involves two teams with two students on each team. Each team is required to answer three questions correctly within 15 seconds. The team with the most correct answers wins the tokens. The third game consists of one team of four students with the active assistance of the entire class. The intent of the third game is to foster camaraderie among all the students by encouraging them to actively support the contestants who can also earn the rest of the class tokens. The team is given 30 seconds to answer ten questions correctly. If the team answers five or more questions correctly then all students in attendance that day are given a token.

### 3.2 Controlling the Learning Process

Students have significant control over when they complete homework assignments and quizzes and how often they want to submit homework assignments. This learner control, according to the Lin and Hsieh (2001), provides intrinsic motivation for successfully completing the class. Students can collect extra-credit points by selecting the "Early Bird Special" (i.e., completing assignments ahead of the due date) and by correctly answering pop questions. Students use the tokens to purchase gifts from Orion's online gift catalog. These include, among others, the option to extend homework and quiz deadlines, expunge grades, and submit past-due homework assignments.

The course contains twelve regular homework assignments. These assignments are application-oriented and cover topics such as working with an Excel spreadsheet (e.g. importing data, manipulating cells using a macro, and creating charts), creating a simple web page, and querying information from a database. Orion grades these assignments automatically and provides valuable formative assessment as recommended by prominent educational researchers; sufficient hints are provided for students' to correct their mistakes and resubmit their answers. Each assignment must be completed by the due date and may be submitted three times before the due date. The multiple submissions provide the necessary practice opportunities as recommended by Fletcher (1990) and Schaffer and Hannafin (1986). The grade recorded is the value earned on the last attempt.

There are five objective quizzes in formats such as multiple-choice, true/false or fill in the blank. Each quiz is administered in the College of Business computer lab during a specified "quiz period" consisting of five weekdays only. Each quiz contains material covered in class during the three weeks prior to the beginning of the quiz period. Students can use their notes as well as other software while taking a quiz. The quiz can be taken only once.

### 3.3. Mastering More Difficult Material

Typically, the treatment of course materials in survey courses is very trivial and superficial. The standard exercises require little more than typing in responses according to the directions. Minimal thought is required to complete the exercises. While it's not the intention to equip students with in-depth IT knowledge, challenging students with more difficult exercises serves two purposes: 1) it forces them to become engaged in the material and 2) it increases their level of self-efficacy so when faced with similar problems outside of class they have the confidence to tackle them on their own (i.e. they can apply the knowledge).

We believe that students are able to master more difficult material because of the practice opportunities (Trabasso, 1987; Kritch and Bostow, 1998) and the feedback they receive from the formative assessments (Black and William, 1998; Wiliam, 2006). The quizzes are structured so that specific practice exercises must be successfully completed before the quizzes can be attempted. These practice exercises, referred to as prerequisites, can be taken as often as necessary to attain the required grade of 100%. Students keep track of their prerequisite practice exercises (see Figure 2) using their Orion account.

Practice assignments and exercises are retrieved, completed, submitted and automatically graded using Orion. During the completion of these exercises students receive feedback through Orion's "On Screen Tip" feature. This allows students to learn through trial and error without fear of penalty. In this non-threatening online environment students are able to learn difficult concepts such as SQL statement creation and Excel Macro generation. Being able to correct mistakes and resubmit exercises reduces quiz anxiety and enhances the learning process; students are able to assimilate the material much faster and more completely.

**Prerequisite Readiness for Sample Student**

Return

This Chart Shows all Course Requirements (top row) for Which There are Prerequisites

You earn permission to complete a course requirement (top row) when all prerequisites (below) are satisfied

Satisfactory prerequisites in green. Unsatisfactory prerequisites are shown in red. Minimum satisfactory score in ( )

Quiz 1	Quiz 2	Quiz 3	Quiz 4	Quiz 5
Data and Information Exercise 01 (100%)	Excel Exercise 01 (100%)	Excel Exercise 05 (100%)	Excel Exercise 07 (100%)	Database Exercise 01 (100%)
Data and Information Exercise 02 (100%)	Excel Exercise 02 (100%)	Excel Exercise 06 (100%)	Excel Exercise 08 (100%)	Database Exercise 02 (100%)
Data and Information Exercise 03 (100%)	Excel Exercise 03 (100%)	HTML Exercise 01 (100%)	Excel Exercise 09 (100%)	Database Syllabus Contract (100%)
SQL Exercise 01 (100%)	Excel Exercise 04 (100%)	Logic Exercise 01 (100%)	Syllabus Contract (100%)	
SQL Exercise 02 (100%)	SQL Exercise 04 (100%)	Logic Exercise 02 (100%)		
Syllabus Contract (100%)	SQL Exercise 03 (100%)	Syllabus Contract (100%)		
Windows Exercise 01 (100%)	Syllabus Contract (100%)			
Windows Exercise 02 (100%)				
Windows Exercise 03 (100%)				

Figure 2: This screen displays the status of students' prerequisite exercises

### 3.4 Earning Extra-Credit Points

Students can make use of an "Early-Bird Special" option to gain extra points by turning in homework assignments and/or attempting quizzes ahead of the due date. The professor determines the number of points awarded, the minimum grade that must be attained to earn the points and the thresholds for different award levels based on how early the material is submitted. For example, the "Early Bird Special" set up for Quiz 2 has three award levels. If the student attempts the quiz on the first open day and attains a score greater than 60%, the student's score is increased by four points. Students attempting the quiz on the second day, earning a score greater than 70% earn two points and those students attempting the quiz on the third day in the quiz period, earning more than 80% increase their score by 1 point. In Figure 3 the student attempted Quiz 2 on the first day, scored more than the requisite 60% and was awarded four additional points.

Whenever students are logged on Orion they are given the opportunity to answer questions about course content. Each correct answer results in an award of 0.10 points. During the semester students receive up to 45 extra-credit pop-questions for a possible 4.5 points. These points can be redeemed in the Gift Catalog.

### 3.5 Purchasing Gifts from the Gift Catalog

Tokens/points earned in class can be redeemed in Orion's Gift Catalog for quiz and homework privileges. Available gifts include due-date extensions for quizzes or homework,

permission to retake a quiz and permission to submit a homework assignment one additional time. The list of gifts and the number of points necessary for each gift are shown in Figure 4.

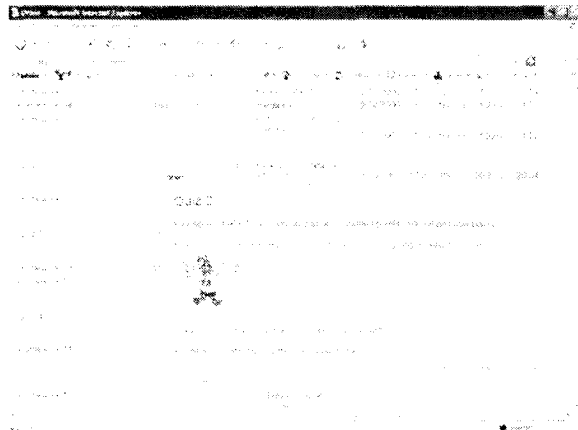


Figure 3: This student earned 4 additional percentage points for Quiz 2: the score was greater than 60% and the quiz was attempted on the first day.

Gift Type	Variation	Options	Points
1. Due date extension	Quiz	3 days	3.3
		2 days	2.3
		1 day	1.4
	Homework	5 days	1
		4 days	0.9
		3 days	0.75
		2 days	0.55
		1 day	0.3
2. Erase a grade	Retake a quiz		4.5
3. Additional submission	Submit 1 more homework		0.15

Figure 4: Gifts available in the online gift catalog

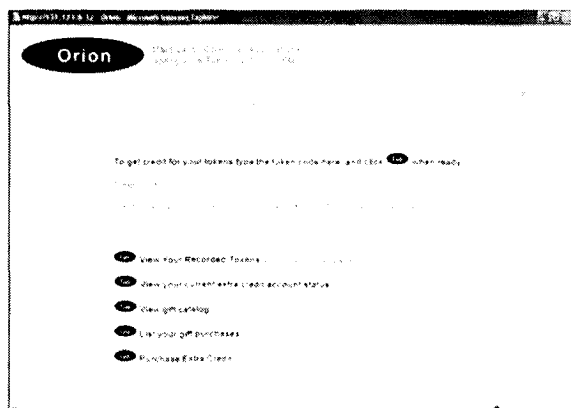


Figure 5: This screen allows students to redeem their tokens and manage their token activity

The Online Gift Catalog is accessed through Orion. After logging in, students select the Gifts/Token option from the Home page and use one of the options in Figure 5 to manage (e.g. redeem tokens, view recorded tokens, status, purchases etc.) their tokens.

A "Rewind" option allows students to turn in overdue assignments for which they are assessed a late fee.

### 3.6 Electronic Administration of Class

Orion performs a significant part of class-related administrative duties automatically. The Orion application is written in ASP.NET and housed on a Windows 2003 Server containing a SQL 2000 database. The Orion system has student and administrator "views". The student view enables students to verify their class status, download a copy of the syllabus, complete homework and quizzes, access the study and practice exercises, manage their tokens and browse the gift catalog. Orion is also used to communicate with the professor as well as other students in the class.

The administrator view enables the professor to set up and manage data about the entire class. Four major sections (shown in Figure 6) are addressed in the administrator view: 1) event calendar, 2) student enrollment, 3) communication, and 4) grades. The calendar section allows the professor to manage the test bank, specify due dates, establish the grading rules and determine the number of points for homework and quizzes. Included in this section is the Extra Credit Management option where test bank questions, game show results and tokens are managed. Reports can be generated that focus on a student's course-related performance in part or overall. Moreover, this option can be used to examine a student's Gift Catalog activities over the course of the class. The game show setup option allows the professor to specify the type of games to be played, the number of questions, the amount of time for each game and the music associated with each game. Lastly, the prerequisite exercises for each quiz are specified in this section.

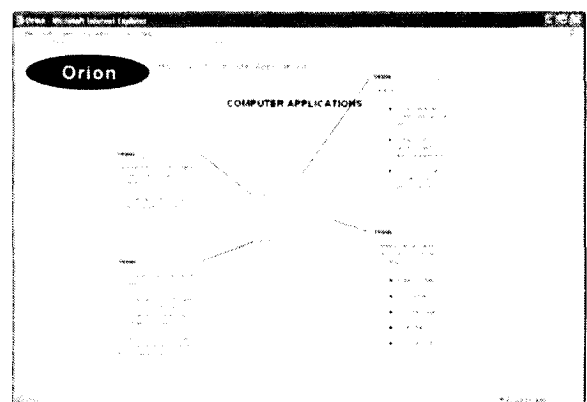


Figure 6: Administrators manage the calendar, student information, communication and grades from this screen.

The Student section allows the professor to view the homework, prerequisite and quiz status report for any number of students. The Communication section is used to publish the syllabus, send e-mails, post messages, visit the chat room, and post handouts. The Grades section allows the professor to view the grades for every assignment for any

number of students. This section is also used to export student grades.

The ability to generate and process tokens makes the Orion system very different from other classroom management applications. Once the tokens are created by the system administrator and won by students, the tokens can be redeemed and become part of the student's Extra Credit History Report. This provides ample opportunity for the professor to analyze the effectiveness of the tokens, the games, and their impact on classroom attendance; the desired information can be obtained through simple database queries.

Most communication-related activities between the professor and students are accomplished via Instant Messenger and e-mail. The professor also has three hours per week set aside for face-to-face communication with the professor at his office.

The office is simply furnished to accommodate as many students as possible to encourage student interaction. Students come for individual help but end up talking with each other and answering their own questions. The professor facilitates rather than controls the learning exchange during office hours. Although the class is administered electronically the students have ample opportunity for personal interaction with the professor if they wish.

#### 4. CONCLUSIONS

The student-centric curriculum described above meets the three curriculum-related goals established at the beginning of this paper. First, student evaluations after the introduction of the new curriculum strongly suggest that the reformulated class is fun and entertaining. Second, students successfully self-regulate the learning process: they choose when to submit their homework and take their exams as well as manage the extra points they've earned. Student comments such as "Orion lets me do things when I want to - I like that" and "I like the feedback Orion gives me - it helps me get my work done" suggest that students prefer to have greater control over the learning experience. Third, students are able to master advanced concepts that are not a part of the curriculum of most other introductory IS courses, such as SQL.

The primary intent of this article was to describe an IS-based curriculum that effectively enhances the learning experience of students enrolled in large introductory IS classes. Although this curriculum focuses on IT, the same didactic techniques can be applied in other disciplines because students learn in a similar manner regardless of the subject matter. Administration of this curriculum makes intensive use of Orion, an online classroom management application. However, numerous other classroom management applications could provide similar functionality. Ultimately, we believe that choosing among the various classroom management applications is primarily a function of the degree to which they can be customized. An advantage of Orion is that both students and their professors have significant control over how they each use it. As of yet, we have not seen another application that can be customized as much or as well as Orion.

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